

**2007 ADDENDUM TO INTERIM MEASURES WORK PLAN  
EAST HELENA FACILITY**

**FORMER ACID PLANT SEDIMENT DRYING AREA  
SLURRY WALL  
MONITORING, OPERATION, AND MAINTENANCE  
WORK PLAN**

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## **Addendum To Interim Measures Work Plan East Helena Facility**

### **Former Acid Plant Sediment Drying Area Slurry Wall Monitoring, Operation, and Maintenance Work Plan**

#### **1.0 INTRODUCTION**

A Consent Decree effective May 5, 1998 between U.S. Environmental Protection Agency (EPA) and ASARCO LLC (Asarco) (U.S. District Court, 1998) initiated the corrective action process in accordance with the RCRA program. As part of the Consent Decree, Asarco prepared several site investigation documents including:

- RCRA Current Conditions/Release Assessment (CC/RA) (Hydrometrics 1999a).
- Interim Measures Work Plan, East Helena Facility (Hydrometrics, 1999b).
- RCRA Facility Investigation (RFI) Work Plan (Hydrometrics, 2000a)
- Phase I RCRA Facility Investigation Report (Asarco Consulting Inc. (ACI) 2003, revised 2005).

A complete listing of RCRA Consent Decree documents is contained in the Phase I RCRA Facility Investigation (RFI) report.

As part of the Consent Decree, several interim measures have been implemented for groundwater between 1999 and 2001. These earlier interim measures (IM) performed as part of the Consent Decree are discussed in Section 1.2 of the RFI. In May 2002, a RCRA Interim Measures Work Plan Addendum (IMWPA) was prepared (Hydrometrics, 2002). The 2002 IMWPA addressed groundwater impact concerns in the intermediate aquifer within the City of East Helena and down-

gradient residential groundwater supplies north of the Asarco plant site. These interim measures are discussed in Section 1.2.1.3 of the IMWPA.

The RFI addresses remaining elements of the site that are not addressed as part of the IM process and will provide sufficient data to develop corrective measures alternatives. The information gathered by the RFI will be used to prepare a RCRA Corrective Measures Study (CMS) for the East Helena Facility. The RFI is being conducted in two phases. The Phase I RFI addressed site characterization that has not been addressed in previous investigations or IM efforts. The Phase II RFI will consist of an assessment of human health and ecological risk. As part of Phase II, a Risk Assessment (RA) Work Plan will be developed in consideration of the data and evaluation presented in the Phase I RFI Site Characterization Report. The Phase II RA Work Plan will address risk assessment objectives, additional data requirements, and procedures for conducting the risk assessment. The development of the Phase II RFI Risk Assessment is discussed in Section 7.0 of the RFI report.

### **1.1 PROPOSED INTERIM CORRECTIVE MEASURES FOR GROUNDWATER**

EPA has expressed its preference for passive corrective measures for control of groundwater at the East Helena site. These measures could include in situ containment such as slurry walls and capping, or in situ treatment options such as soil fixation or permeable barrier walls. As a result of discussions between EPA, Asarco and MDEQ, groundwater corrective actions will focus on three general areas:

1. The former acid plant sediment drying area,
2. The speiss/dross area, and
3. The elevated groundwater arsenic plume down-gradient from these areas.

As a result of the April 2006 meetings between Asarco, EPA and MDEQ, and the follow-up of several action items as a result of the meetings (including preparation of cost estimates by engineers and contractors), the general strategy for groundwater corrective actions at the East Helena Facility is as follows:

- Slurry wall construction and temporary capping of the former acid plant sediment drying area. This project was completed in the Fall 2007. The trace of this slurry wall is shown on Figure 1-1.
- Slurry wall construction and capping of the speiss/dross area.
- Construction of a PRB near the area of the present PRB test wall.

The Groundwater Corrective Action Plan - 2006 (Asarco, August 2006) presented the conceptual design for implementation of these actions. In 2006, groundwater remedial actions were focused on construction of a slurry wall and placement of a temporary cover in the former acid plant sediment drying area. As part of implementation of this project, several work plans have been prepared that address construction of a slurry wall and temporary cover in the former acid plant area including:

- 2006 Phase 1, Phase 2 and Phase 3, Final Cleaning, Soil Sampling Backfilling and Interim Cap Work Plan (Asarco, 2006b). (This document addresses the temporary cover design that was placed in the former acid plant sediment drying area),
- Design Basis Memorandum, Asarco Former Acid Plant Sediment Drying Area Slurry Wall, East Helena, Montana (Shaw E&I 2006a),
- Work Plan, Former Acid Plant Sediment Drying Area Slurry Wall, October 4, 2006 (Shaw E&I 2006b),
- Construction Quality Control Plan, Former Acid Plant Sediment Drying Area Slurry Wall (Shaw E&I 2006c),
- Site Specific Health and Safety Plan for Slurry Wall Construction at the Former Sediment Drying Area (Shaw E&I 2006d),
- Permeability Testing for Slurry Cutoff Wall Memorandum, (Shaw E&I 2006e) and,
- Permeability Testing for Slurry Wall Cutoff Wall, Asarco East Helena, Montana, October 9, 2006, GeoSolutions Inc., 2006.

The design for the slurry wall around the former acid plant sediment drying area included the following features:

- The wall is 800 feet long, 33 feet deep and 3 feet wide.
- The wall was keyed a minimum of 2 feet into the underlying low permeability ash unit.
- The wall was constructed using the same excavation equipment used for the test PRB.
- Standard bentonite grout was used for slurry wall construction.

The slurry wall around the former acid plant sediment drying area was constructed during late fall, October and November, 2006. A Construction Completion Report documents construction and results of quality control testing (Shaw E&I, 2007). A Soil-Bentonite Permeability and Compatibility Testing Report documents the performance of the bentonite slurry used for construction of the slurry wall (Geo-Solutions Inc., 2007).

## **1.2 2007 IM WORK PLAN ADDENDUM SCOPE AND OBJECTIVES**

In October 2006, a Monitoring, Operation, and Maintenance Work Plan for the former acid plant sediment drying area was developed and submitted to EPA (Asarco, 2006c). The plan included the construction of several additional groundwater monitoring wells, including well points within the slurry wall and a new well located adjacent to the new slurry wall. This construction was designed to supplement the existing monitoring well network within and adjacent to the slurry wall. However, these elements of the Monitoring O&M Plan were not implemented for the following reasons:

- Installation of groundwater monitoring wells within the wall proved impractical during slurry wall construction. At the recommendation of the slurry wall construction contractor (Shaw), these groundwater monitoring wells were not installed because placement could not be successfully achieved through the slurry soil mix without breaking the

PVC casing. Furthermore, the positioning of the wells would result in reduced wall thickness and overall effectiveness.

- Installation of the groundwater monitoring wells adjacent to the slurry well was delayed because of the severe winter weather and Asarco's desire to coordinate this effort with the construction of an additional well in the CAMU area. To maximize efficiency, the construction effort was scheduled to take place along with the abandonment program of groundwater monitoring wells that would be impacted during the scheduled 2007 cleaning and demolition project. The proposed well abandonment program was submitted to EPA for review in March 2007 (Asarco 2007). Figure 1-2 shows the wells that are proposed for abandonment. Two of these wells that are scheduled for abandonment, (DH-44 and DH-45) were included as part of the slurry well abandonment program and will be replaced for slurry wall monitoring purposes (see Section 2.0 below).

As a result of these events, EPA has directed Asarco to amend the Work Plan to reflect the changes discussed above. This 2007 Work Plan revision presents these updates to the Slurry Wall Monitoring, Operation, and Maintenance Work Plan.

The objectives of this 2007 IM Work Plan Addendum for slurry wall monitoring, maintenance and operation are:

- Present the monitoring well network that will be used to monitor the effectiveness of the slurry wall and cap area after construction is complete,
- Present the testing and sampling program for the slurry wall area, and
- Present operation and maintenance procedures.



## **2.0 FORMER ACID PLANT SEDIMENT DRYING AREA MONITORING AND TESTING PROGRAM**

The performance of the slurry wall will be monitored using existing and new monitor wells in the former acid plant sediment drying slurry wall area. The slurry wall monitoring network is shown on Figure 1-1. A total of 10 existing wells, two new wells, and two surface water level sites will be used to assess performance of the completed slurry wall. Slurry wall performance will be monitored by:

- Monitoring groundwater levels inside the slurry wall footprint, and up and down gradient of the slurry wall.
- Collection and analysis of groundwater quality samples within the area surrounded by the slurry wall, and down gradient of the slurry wall to monitor future changes over time.
- Laboratory testing of long-term wall slurry permeability to assess wall permeability characteristics over time. This action has been completed and the results of the long-term testing indicate a wall permeability of  $4 \times 10^{-8}$  cm/sec (Geosolutions, 2007).

Table 2-1 summarizes the slurry wall groundwater monitoring and sampling program.

### **2.1 CONSTRUCTION OF NEW MONITORING WELLS**

A total of two new monitoring wells (APSD-15 and APSD-16) will be constructed adjacent to the slurry wall. These wells will supplement existing wells that are located inside the slurry wall footprint (APSD-1, APSD-2, APSD-3, and DH-29) and wells located outside the slurry wall area (APSD-4, APSD-10, APSD-12, and DH-47) (see Figure 1-1). APSD-15 and APSD-16 will also replace two down-gradient wells (DH-45 and DH-46) that will be abandoned because they would not survive demolition activities presently scheduled to commence in 2007 (see Figure 1-2). Prior to abandonment of DH-45 and DH-46, water levels will be measured and water quality samples will be collected to provide final information from these locations and to provide comparative data for the replacement wells.

Table 2-2 summarizes the supplemental well installation program. In general, the wells will be typical shallow monitoring well construction consisting of 2-inch I.D. NFS approved schedule 40 PVC with flush joint couplings and factory slotted screen. Figure 2-1 shows typical construction details. Wells APSD-15 and APSD-16 will be installed just outside the wall in the direction of downgradient groundwater flow to examine adjacent water levels and groundwater quality changes.

Well construction will include documentation, and sampling using procedures and techniques defined in the EPA approved IM Interim Measures Work Plan, East Helena Facility (Hydrometrics, 1999b), and the RCRA Facility Investigation (RFI) Work Plan (Hydrometrics, 2000a). The wells located outside the wall will be construction using air rotary methods, necessary to drill through the extensive boulders, cobbles, and gravel typical of the East Helena facility area. All wells and boreholes will be logged for stratigraphy and completed by a professional scientist or engineer.

## **2.2 GROUNDWATER MONITORING AND TESTING PROGRAM**

Table 2-1 summarizes the slurry wall monitoring and evaluation program. Groundwater samples will be collected and analyzed for field parameters, dissolved metals and arsenic, and common ions. The sampling and measurement procedures will be conducted in accordance with the IM Interim Measures Work Plan, East Helena Facility (Hydrometrics, 1999b), and the RCRA Facility Investigation (RFI) Work Plan (Hydrometrics, 2000a). Concurrent with sample collection, water levels of the described monitoring wells will be measured. Slurry wall groundwater monitoring will be conducted quarterly for the first year. After 1 year, the data will be reviewed. Pending an evaluation of results, the monitoring frequency may be reduced to semiannual monitoring and conducted concurrently with the spring and fall long-term post-RI/FS monitoring program for the East Helena Site.

In addition to water level measurement, slug testing will be conducted on the new wells (APSD-15 and APSD-16) to determine permeability characteristics. Testing

will be conducted in accordance with procedures described in the IM Interim Measures Work Plan, East Helena Facility (Hydrometrics, 1999b), and the RCRA Facility Investigation (RFI) Work Plan (Hydrometrics, 2000a).

### **3.0 SLURRY WALL AND CAP OPERATION AND MAINTENANCE PLAN**

#### **3.1 SLURRY WALL O&M**

Following installation, minimal maintenance of the wall is anticipated. As described above, the performance of the wall will be evaluated through water level monitoring, water quality sampling, and field permeability testing.

Periodic inspections of the wall construction area will be conducted to monitor the wall footprint for settling following completion of the wall. Some minor settlement is anticipated. If necessary, additional fill may be added to maintain the design drainage of the area. In general, operation and maintenance actions will be incorporated as part of the drainage and cap inspections for the area (see Section 3.2 below)

#### **3.2 TEMPORARY CAP O&M**

In addition to slurry wall construction in 2006, the area within the slurry wall includes a temporary cover as described in the Interim Cap Work Plan (Asarco 2006b). A temporary cover was installed instead of a permanent cover in 2006 since demolition of additional structures adjacent to the slurry wall area is anticipated in 2007 and 2008 (see Figure 1-2, near wells DH-45 and DH-46). Following completion of this activity, a permanent cap may be installed as described in the Groundwater Corrective Action Plan (Asarco 2006a). Figure 2-2 showed details for the temporary cap and drainage plan for the slurry wall area in the former acid plant sediment drying area.

Temporary cap O&M procedures are described in the Interim Cap Work Plan. (Asarco 2006b) Periodic inspections of the interim cap are being conducted to ensure that the temporary cap systems are performing adequately and to identify problems and provide proper maintenance of temporary cap systems. The inspection program involves three types of inspections: (1) informal inspections, (2) periodic technical inspections, and (3) special inspections after extreme events (see Section 2.6, Interim Cap Work Plan, Asarco 2006b).

#### 4.0 SLURRY WALL PROGRAM SCHEDULE

Slurry wall and temporary capping construction was completed in the fall 2006. The following schedule outlines the anticipated slurry wall monitoring, testing, and O&M activities for the former acid plant sediment drying area.

<ul style="list-style-type: none"><li>• Conduct water level measurement and water quality sampling for DH-45 and DH-46, prior to Abandonment</li></ul>	<ul style="list-style-type: none"><li>• April 23, 2007 – April 27, 2007</li></ul>
<ul style="list-style-type: none"><li>• Construct new downgradient monitoring wells APSD-15 and APSD-16 adjacent to slurry wall</li></ul>	<ul style="list-style-type: none"><li>• April 23, 2007 – April 27, 2007</li></ul>
<ul style="list-style-type: none"><li>• Abandon wells DH-45 and DH-46</li></ul>	<ul style="list-style-type: none"><li>• April 30, 2007 – May 4, 2007</li></ul>
<ul style="list-style-type: none"><li>• Perform slug tests in new monitoring wells</li></ul>	<ul style="list-style-type: none"><li>• May 2007</li></ul>
<ul style="list-style-type: none"><li>• Conduct water level measurement and water quality sampling</li></ul>	<ul style="list-style-type: none"><li>• May 2007</li><li>• August 2007</li><li>• November 2007</li><li>• February 2008</li></ul>
<ul style="list-style-type: none"><li>• Evaluation of slurry wall performance</li></ul>	<ul style="list-style-type: none"><li>• May 2007 through May 2008</li></ul>
<ul style="list-style-type: none"><li>• Conduct wall and temporary cap inspections. Provide maintenance as necessary</li></ul>	<ul style="list-style-type: none"><li>• Monthly, and/or after special events (rain, wind quake, etc).</li></ul>

## 5.0 REFERENCES

- Hydrometrics, 2000c. Groundwater Source Control Interim Measures Design Analysis, Plans and Specifications, East Helena Facility, March 2000.
- Hydrometrics, 1999b. Interim Measures Work Plan, East Helena Facility, April 1999, Revised July 1999. Includes Volume II, Corrective Action Management Unit Design Report.
- Asarco, 2006a. Asarco East Helena Smelter, Groundwater Corrective Action Plan – 2006, August 30, 2006.
- Asarco, 2006b. Asarco East Helena Smelter, 2006 Interim Measures Work Plan Addendum, 2006 Phase 1, Phase 2 and Phase 3, Final Cleaning, Soil Sampling Backfilling and Interim Cap Work Plan, September 26, 2006.
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- Shaw E&I, 2006a. Design Basis Memorandum, Asarco Former Acid Plant Sediment Drying Area Slurry Wall, East Helena, Montana, October 3, 2006.
- Shaw E&I, 2006b. Work Plan, Former Sediment Drying Area Slurry Wall, October 4, 2006.
- Shaw E&I, 2006c. Construction Quality Control Plan, Former Sediment Drying Area Slurry Wall, October 4, 2006.
- Shaw E&I, 2006d. Site Specific Health and Safety Plan for Slurry Wall Construction at the Former Sediment Drying Area, October 4, 2006.
- Shaw E&I, 2006e. Permeability Testing for Slurry Cutoff Wall Memorandum, October 11, 2006.
- Shaw E&I, 2007. Construction Completion Report, Former Acid Plant Sediment Drying Area Slurry Wall, ASARCO Smelter Facility, East Helena, MT, January, 2007.

## TABLES

TABLE 2-1. SLURRY WALL GROUNDWATER SAMPLE COLLECTION AND ANALYSIS MATRIX

Sample Location	Purpose	Sampling Frequency	Number of Sampling Events	Total Non-QC Samples	Analytical Parameters	Field and Laboratory Methods <sup>(2)</sup>	Project Detection Limit Goal (mg/L)	Field QC Samples <sup>(3)</sup>		Total Samples
								Field Duplicates	Field D.I. Blanks	
DH-45	Monitor groundwater levels and quality down-gradient of slurry wall To be abandoned and replaced by new well APSD-15	One-time in Spring 2007 Prior to Abandonment	1	2	<u>Field Parameters</u> pH specific conductance dissolved oxygen temperature SWL (static water level)	HF-SOP-20 HF-SOP-79 HF-SOP-22 HF-SOP-84 HF-SOP-10		1	1	2
DH-46	Monitor groundwater levels and quality down-gradient of slurry wall To be abandoned and replaced by new well APSD-16									
APSD-15	Monitor groundwater levels and quality down-gradient of slurry wall	Quarterly for 1 Year	4	36	<u>Laboratory Parameters</u> <u>Common Constituents</u> pH SC Ca Mg Na K HCO <sub>3</sub> SO <sub>4</sub> Cl TDS TSS Total Alkalinity as CaCO <sub>3</sub>	SM 4500H-B SM 2510 B E200.7 E200.7 E200.7 E200.7 SM 2320 B SM 4500S04 E SM 4500CL C SM 2540 C SM 2540 D SM 2320 B		4	4	8
APSD-16	Monitor groundwater levels and quality down-gradient of slurry wall									
DH-29	Monitor groundwater levels and quality inside slurry wall foot print	Semi-Annual After 1 Year								
APSD-1	Monitor groundwater levels and quality inside slurry wall foot print									
APSD-2	Monitor groundwater levels and quality inside slurry wall foot print									
APSD-3	Monitor groundwater levels and quality inside slurry wall foot print									
APSD-4	Monitor groundwater levels and quality down-gradient of slurry wall									
APSD-15	Monitor groundwater levels and quality down-gradient of slurry wall									
APSD-16	Monitor groundwater levels and quality down-gradient of slurry wall									
						<u>Trace Constituents<sup>(1)</sup></u> As (tot & dis) Cd (tot & dis) Cu (tot & dis) Fe (tot & dis) Mn (tot & dis) Pb (tot & dis) Zn (tot & dis) As III, As V	200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 200.7/200.8 E 1632A M	0.005 0.001 0.004 0.02 0.015 0.005 0.02 0.005		
APSD-10	Monitor groundwater levels upgradient of slurry wall	Quarterly for 1 Year	4		<u>Field Parameters</u> SWL (static water level)	HF-SOP-10				
APSD-12	Monitor groundwater levels upgradient of slurry wall									
Lower Lake	Measure water level	Semi-Annual After 1 Year								
Upper Lake	Measure water level									
APSD-15	Permeabilty test (slug test) downgradient of wall	One time event	1		<u>Field Parameters</u> SWL (static water level) Slug Tests	HF-SOP-10 Bower Rice				
APSD-16	Permeabilty test (slug test) downgradient of wall									

(1) Samples will be analyzed for total metals and for dissolved constituents (field-filtered through a 0.45 µm filter prior to preservation).

(2) Field methods HF-SOP numbers refer to Standard Operating Procedures (see Quality Assurance Project Plan [QAPP] in Volume III RFI Work Plan (Hydrometrics 2000), Appendix C for details).  
Laboratory methods from EPA's Test Methods for Evaluating Solid Waste, SW-846 (1992) or Methods for Chemical Analysis of Water and Wastes (1983). Details on individual analytical methods are given in the RFIWP QAPP (Appendix D ).  
For trace constituents and major cations, Method 6010 is ICP, Method 6020 is ICP-MS, and other methods are flame or graphite furnace AA.

(3) Field duplicates and blanks will be collected at a minimum frequency of 1 per 20 field samples. One field standard will be submitted with the groundwater samples.



**TABLE 2-2. CONSTRUCTION FOR SUPPLEMENTAL SLURRY WALL MONITORING WELLS**

Location	Well Name	Type	Casing Size (inches)	Area of Evaluation	Approximate Ground Surface Elevation (feet)	Approximate Static Water Level (ft bgs)	Anticipated Total Depth (feet)	Total Depth Elevation (feet)	Anticipated Screen Interval (ft bgs)
Former Acid Plant Sediment Drying Area	APSD-15	MW	2	Down-gradient of the Slurry Wall	3919	8	31	3888	6-31
	APSD-16	MW	2	Down-gradient of the Slurry Wall	3918	8	31	3887	6-31

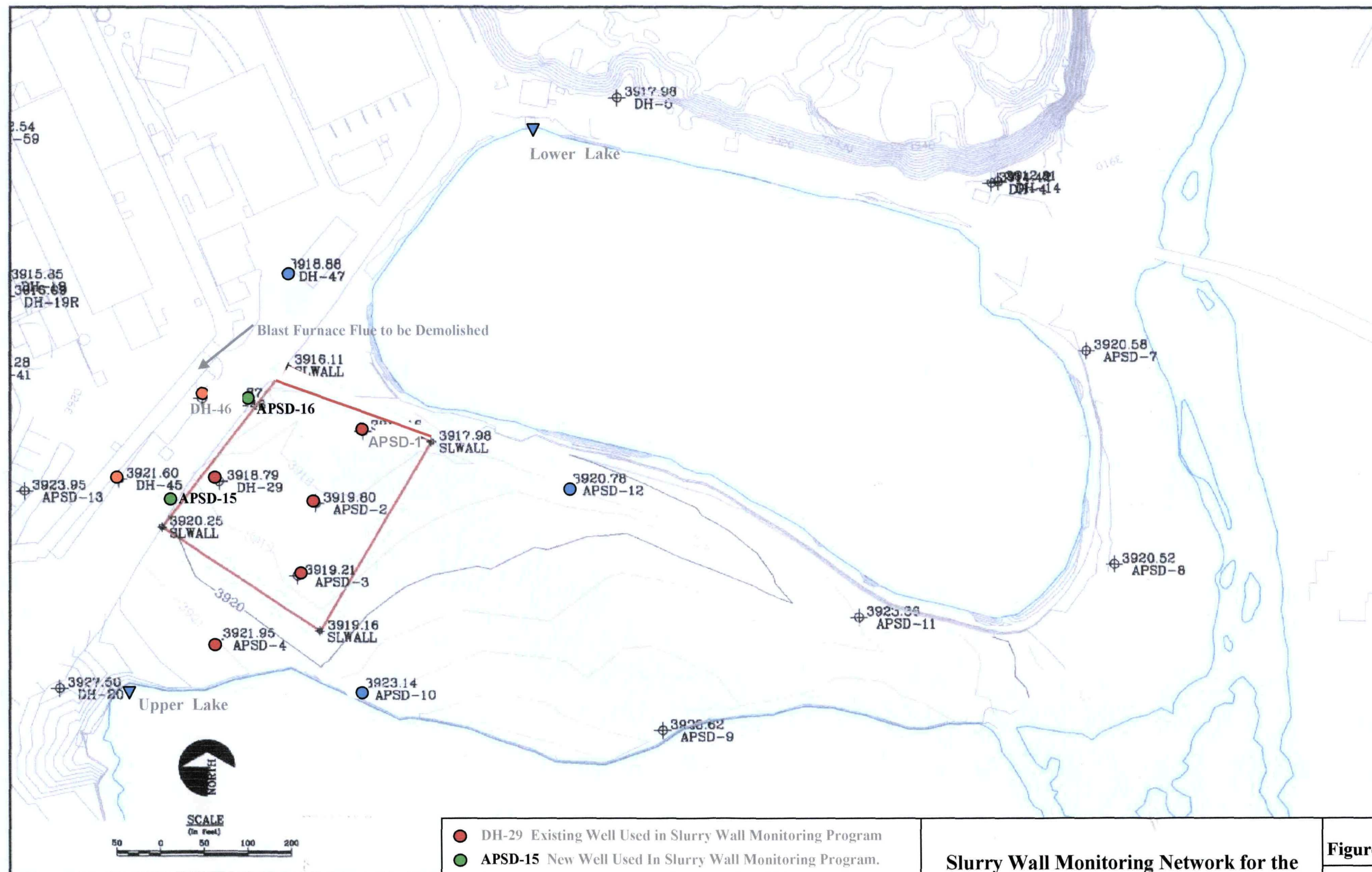
Note: Listed casing size is inside diameter.

ft bgs = feet below ground surface

Elevations in feet above mean sea level

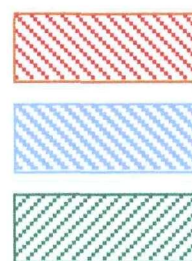
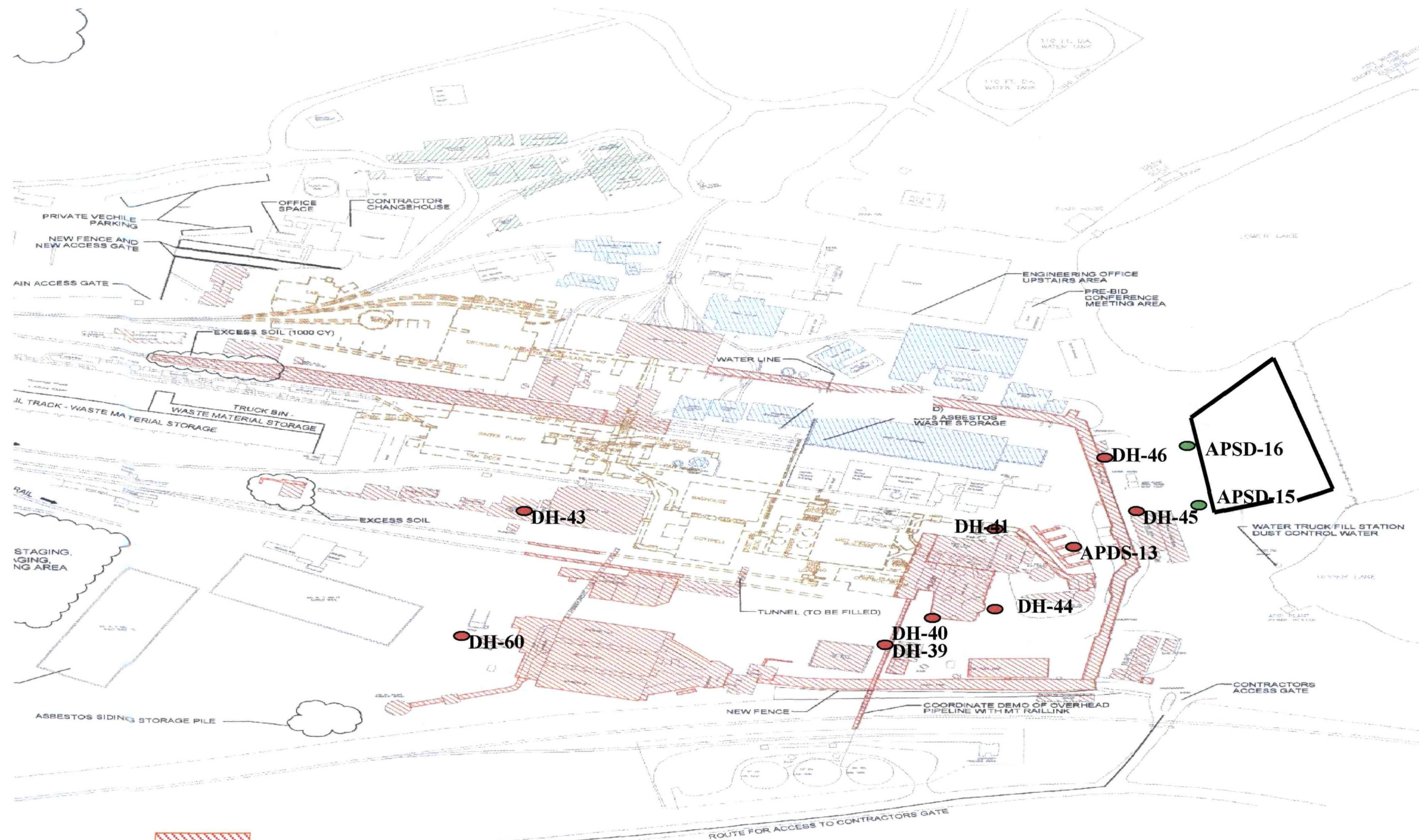
MW = Monitoring Well

## FIGURES



SlurryWall101606.ppt





Structure Scheduled for Demolition in 2007

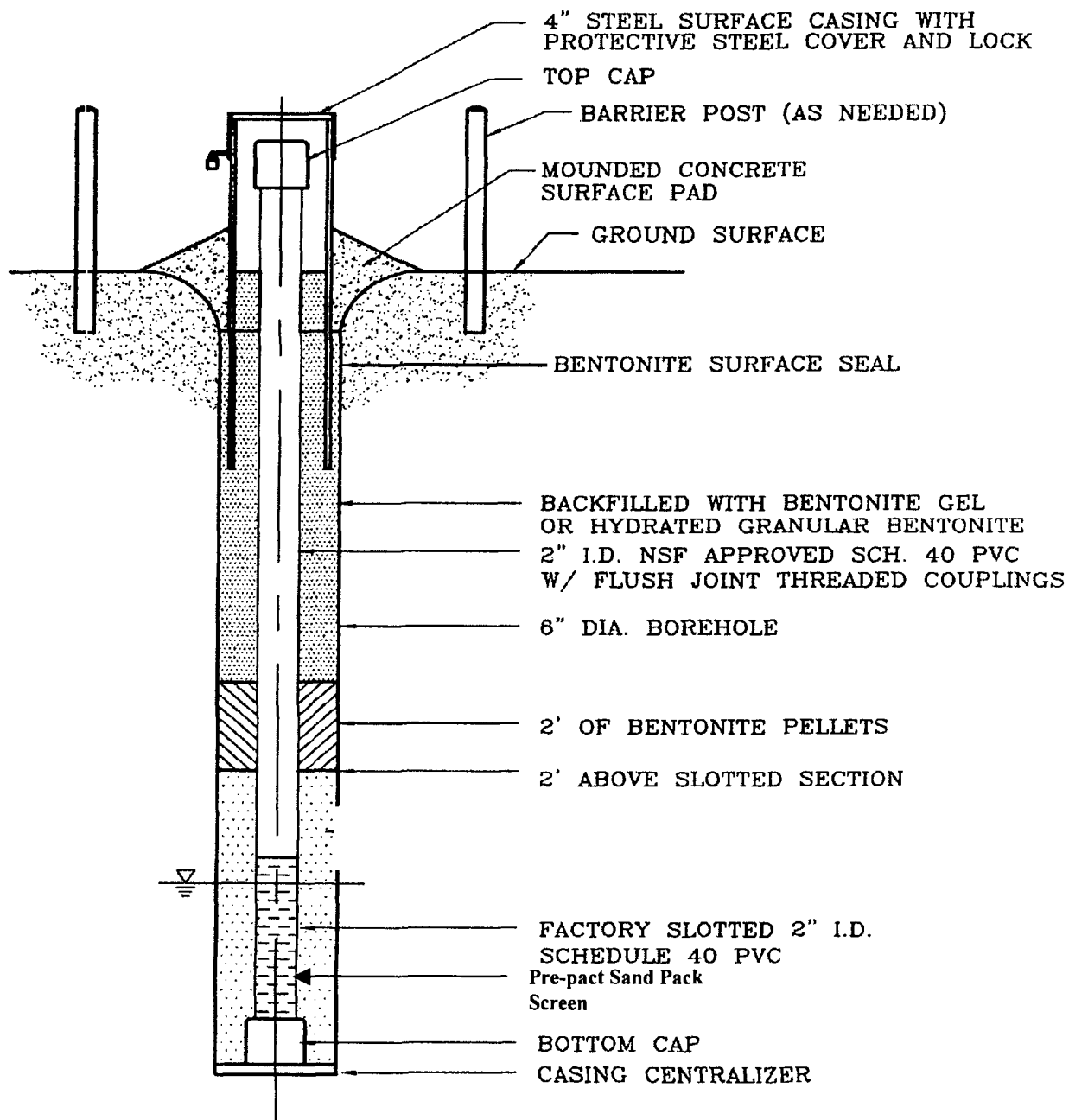
2007 Additive Alternate A Schedule for Demolition

2007 Additive Alternate B Schedule for Demolition

● DH-46 Well Proposed for Abandonment

● APSD-15 Proposed Replacement Well

Figure 1-2. Monitoring Wells To Be Abandoned



NOT TO SCALE

RCRA FACILITY INVESTIGATION  
EAST HELENA FACILITY

**TYPICAL SHALLOW  
MONITORING WELL CONSTRUCTION**

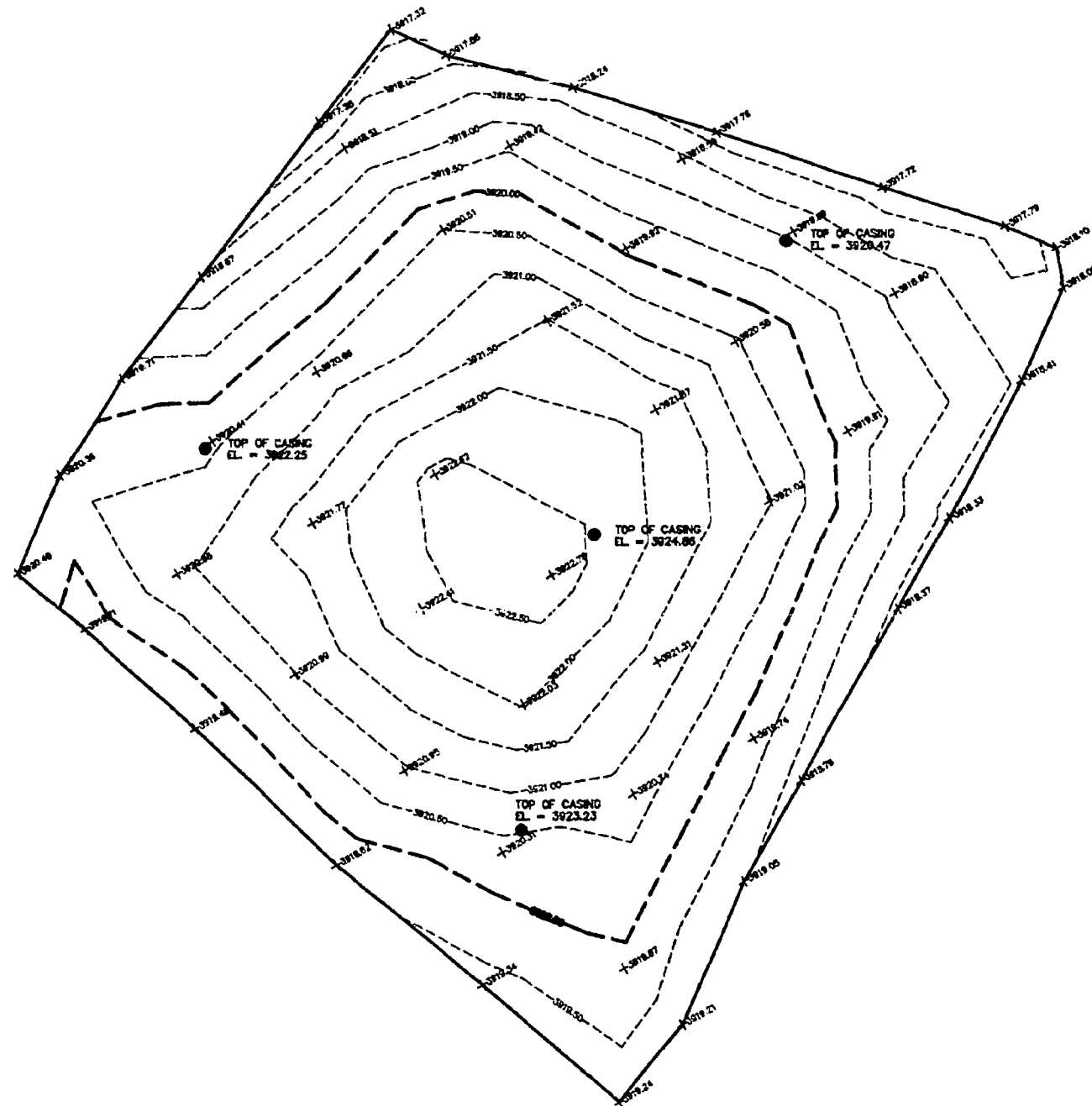
FIGURE

2-1

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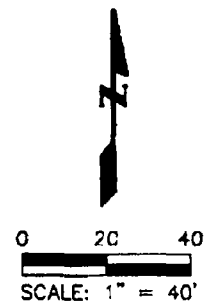
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NES CONTROL POINT NO. 104  
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CAP MARKED "NES CONTROL" △  
ELEV. = 3919.93

# LEGEND

- EDGE MEMBRANE
- △ N.E.S. CONTROL POINT
- +XXX.XX SPOT ELEVATION
- - - - - CONTOUR LINE
- MONITORING WELL




A		ISSUED TO ASARCO, LLC		ERC	NR	01/8/07
REVISION	DESCRIPTION			CHECKED	APPROVED	DATE
<b>ASARCO, LLC</b>						
ASARCO SMELTER FACILITY						
TEMPORARY CAP AT FORMER ACID PLANT SEDIMENT DRYING AREA SLURRY WALL						
 <b>Shaw Environmental, Inc.</b>						
BY	DATE	BY	DATE	PROJECT NO.	REV.	FILE NAME
DSND	ERC	01/18/07	CHND	ERC	01/18/07	123157.3000
DRAWN	MEC	01/18/07	APPR	MEC	01/18/07	A 123157A05A

Figure  
3-1